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# Critical role of wind-wave induced erosion on the morphodynamic evolution of shallow tidal basins

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Wind-wave induced erosion processes are among the chief processes which govern the morphodynamic evolution of shallow tidal basins, both in the vertical and in the horizontal plane. Wind-wave induced bottom shear stresses can promote the disruption of the polymeric microphytobenthic biofilm and lead to the erosion of tidal-flat surfaces and to the increase in suspended sediment concentration which affects the stability of intertidal ecosystems. Moreover, the impact of wind-waves on salt-marsh margins can lead to the lateral erosion of marsh boundaries thus promoting the disappearance of salt-marsh ecosystems.

Towards the goal of developing a synthetic theoretical framework to represent wind wave-induced resuspension events and account for their erosional effects on the long-term biomorphodynamic evolution of tidal systems, we have employed a complete, coupled finite element model accounting for the role of wind waves and tidal currents on the hydrodynamic circulation in shallow basins. Our analyses of the characteristics of combined current and wave-induced exceedances in bottom shear stress over a given threshold for erosion, suggest that wind wave-induced resuspension events can be modeled as a marked Poisson process. The interarrival time of wave-induced erosion events is, in fact, an exponentially distributed random variable, as well as the duration and intensity of overthreshold events.

Moreover, the analysis of wind-wave induced resuspension events for different historical configurations of the Venice Lagoon from the 19th to the 21st century, shows that the interarrival times of erosion events have dramatically decreased through the last two centuries, whereas the intensities of erosion events have experienced a surprisingly high increase. This allows us to characterize the threatening erosion and degradation processes that the Venice Lagoon has been experiencing since the beginning of the last century.